WATER DESALINATION IN CALIFORNIA

OPPORTUNITIES AND CHALLENGES

PREPARED
FOR
THE DELTA VISION
BLUE RIBBON TASK FORCE

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WHAT IS DESALINATION?

Desalination, also known as desalting or desalinization, is the process of removing dissolved salts and minerals from saline water to produce fresh potable water. In addition to salts, desalination processes can also be used to remove organics, pathogens, and other contaminants. Desalination was explored very early in history and its use goes back to ancient times, where simple distillation techniques were employed. Nowadays, brackish water and seawater desalination is becoming common practice to meet fresh water needs in many parts of the world especially the arid regions of the Middle East and North Africa and many island communities such as the Canary Islands and Malta. Currently, there are over 13,000 desalination plants worldwide producing close to 8 million acre-feet of desalinated water. And it is reported that desalination might grow by 10 - 20 % annually in the coming decade. Desalination technology is also used to treat wastewater effluents for reuse purposes and to improve the quality of fresh water for potable and industrial uses. Key issues associated with the use of desalination include: cost, energy use, and environmental impacts of brine disposal and feedwater intake.

DESALINATION POTENTIAL AND OPPORTUNITIES

The California Water Desalination Task Force - called for by Assembly Bill (AB) 2717, (Chapter 957, Statutes of 2002) and convened by the Department of Water Resources (DWR) in 2003 - stated in its report to the Legislature that "the opportunities are great for providing water supply from seawater and brackish water desalination as well as recovering contaminated groundwater." The report further states that "Although desalination will contribute less than 10 percent of the total water supply the state needs, it still represents a significant portion of the state's water supply portfolio." In addition, desalination provides other benefits and unique opportunities that were acknowledged by the Task Force and stated in their findings to include 1) providing additional water supply to meet existing and projected demands; 2) replacing water lost from other sources and relieving drought conditions; 3) enhancing water reliability and supplying high quality potable water; 4) reducing groundwater overdraft and restoring use of polluted groundwater; and 5) replacing water that can be used for river and stream ecosystem restoration[1].

The Task Force emphasized that desalination should be considered, where economically and environmentally appropriate, as an element of a balanced water supply portfolio, which also includes conservation and water recycling to the maximum extent practicable (Recommendation #2). It also directed that "since each desalination project is unique and depends on project-specific conditions and considerations, each project should be evaluated on a case-by-case basis (Recommendation #1).

KEY ISSUES AND CHALLENGES

Key issues and unique challenges associated to desalination include:

[1] http://www.owue.water.ca.gov/recycle/desal/Docs/Findings-Recommendations.pdf

Cost and Affordability – Desalination has historically been prohibitively expensive. The improvements in technology and the rising cost of conventional water supplies has made desalination competitive with importing water and recycled municipal wastewater in a number of cases. The cost will be influenced by the type of feedwater, the available concentrate disposal options, the proximity to distribution systems, and the availability and cost of power. The higher costs of desalting may, in some cases, be offset by the benefits of increased water supply reliability and/or the environmental benefits from substituting desalination for a water supply with higher environmental costs. The total amortized production cost of reverse osmosis desalination ranges from $860/AF to $1,300/AF (assuming electricity costs of $0.08/kWh). On the average, an increase in electric energy cost of $0.01/kWh would increase the total cost of desalination by $53/AF of desalinated water.

Environmental Impact and Permitting – Brackish water desalination plants have fairly routine environmental and permitting requirements. Coastal desalination plants face much closer scrutiny. With a location within the coastal zone, and with the need for water intakes and outfalls, there are many reviewing agencies, organizations, and permitting requirements.

Seawater Intakes – Existing seawater intakes for power plant cooling are proposed as the source of supply for almost all of the currently proposed plants. In general, these existing intake systems have been shown to have fairly significant impacts on the coastal zone. A number of coastal power plants that use once-through cooling water from the ocean may cease operation or convert to a "dry" cooling system. In addition, some plants are not in continuous operation. These may limit the potential capacity of seawater desalting on the coast.

Concentrate Discharge – Desalination plants of any type produce a salt concentrate that must be discharged. The quantity and salinity of that discharge varies with the type of desalting plant and its operation. Brackish water plants in California discharge their concentrate to municipal wastewater treatment systems where they are treated and blended with effluent prior to discharge. For brackish water plants, this type of discharge is likely to continue. Inland desalting plants without a discharge to the ocean may be limited by the type of discharge options available. Seawater desalination produces a concentrate approximately twice as salty as seawater. In addition, residuals of other treatment chemicals may also be in the concentrate. The plants currently being planned are to utilize existing power plant outfall systems to take advantage of dilution and mixing prior to discharge. The availability of power plant cooling systems to dilute the concentrate prior to discharge to the ocean will also be affected by the future of coastal power plants as discussed in the prior section.

Energy Use – Desalination's primary operation cost is for power. A 50 mgd seawater plant (approximately 50,000 acre-feet per year assuming operating 90% of the time) would require about 33 MW of power. Forecasted seawater desalination of about 187,000 acre-feet per year would require about 123 MW of power. The reduction in unit energy use has been among the most dramatic improvements in recent years due to improvement in energy recovery systems. Though the cost of the energy consumption of desalination is still a limiting factor to economical desalination projects, energy consumption by reserve osmosis, a main technology expected to be utilized in California is coming down to a level comparable with energy requirement to exported State Water Project water to Southern California (~3,000 kWh/AF).

Growth-inducing Impacts – The availability of water has been a substantial limitation on development in a number of locations, primarily coastal communities. Since desalination on the coast is now a much more affordable option in comparison to the past, the lack of water may no longer be as strong a constraint on coastal development.

DESALINATION IN CALIFORNIA

Currently in California desalination technologies generates approximately 180,000 acre-feet of potable water; over 95% generated from brackish water sources. The 2005 California Water Plan, is projecting a potential of about 0.5 million acre-feet of additional desalinated water by the year 2030. Of that amount, about 200,000 acre-feet would be oceanwater desalination. This potential of new water could meet the household water demands of about 20 percent of the additional 12 million Californians projected by 2030.

The California State Legislature has recognized the future importance of seawater and brackish water desalination through legislation. In 2002, the Legislature approved AB 2717 (Hertzberg), which asked DWR to convene the California Water Desalination Task Force to look into potential opportunities and impediments for using seawater and brackish water desalination, and to examine what role, if any, the State should play in furthering the use of desalination technology.

In 1999, Senate Bill 1062 (Poochigian - Water Code § 10004) mandated that DWR include in the Water Plan Update (Bulletin 160) a discussion of various strategies, including new water storage facilities, water conservation and recycling, desalination, conjunctive use, and water transfers. In 2003, AB 314 (Kehoe) declared that it is the policy of the State that desalination projects developed by or for public water entities be given the same opportunities for state assistance and funding as other water supply and reliability projects, and that desalination be consistent with all applicable environmental protection policies in the state.

In November 2002, California voters passed Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. Chapter 6(a) of Proposition 50 (Water Code Section 79545(a)) authorized DWR to administer a $50 million desalination grant program. The grant program aims to assist local public agencies with the development of new local potable water supplies through the construction of feasible brackish water and ocean water desalination projects and help advance water desalination technology and its use by means of feasibility studies, research and development, and pilot and demonstration projects. DWR conducted two rounds of funding under this grant program and competitively awarded the available proposition 50 desalination grants to 48 projects including: 7 construction projects, 14 research and development projects, 15 pilots and demonstrations, and 12 feasibility studies.